C3 Results from Visual Inspection

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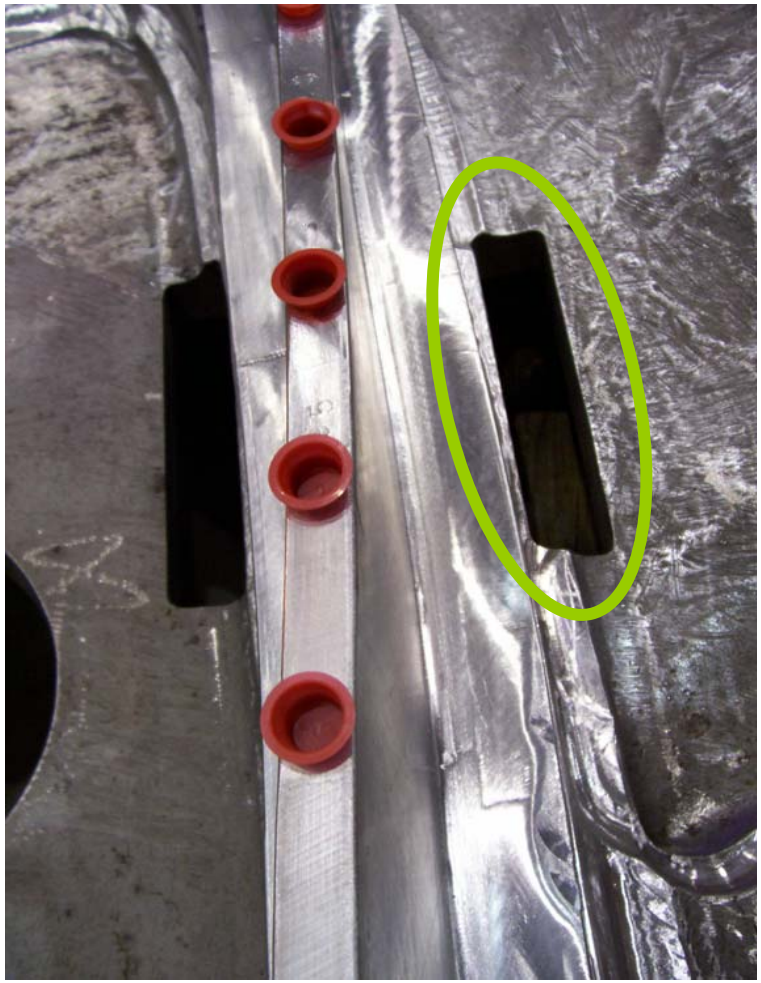
General Notes

- These findings and observations are based upon preliminary inspection of received C3 winding form, and does not include any formal dimensional inspections
- This report includes general findings including those already identified with NCR's
- Finished surfaces on septum appear to have more tool cutter errors than C1 and C2
- Area for positioning weld studs has been greatly improved
- C3 required 3.5 days of in-house work prior to being ready for use

Items for Discussion

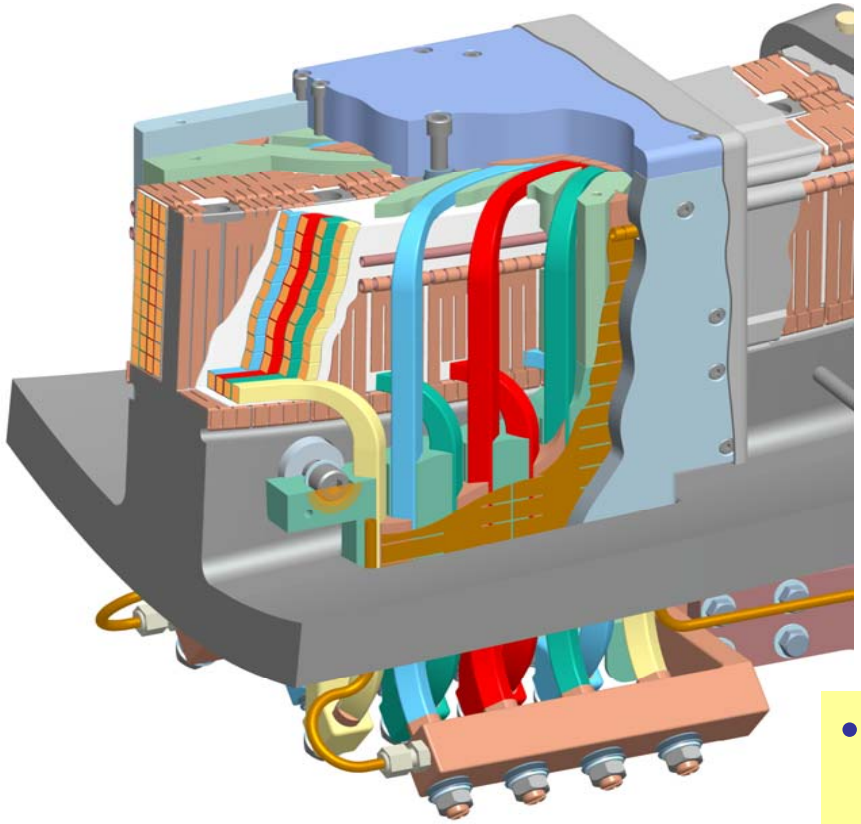
- Lead Area Slots
- Divots
- Miscellaneous
- Permeability
- Edge tool cutting errors
- Poloidal Break
- Misaligned Holes
- Summary

Lead Area- Slot



- Significant edge was left in lead slot
- Cannot use as is G-11 lead filler will not fit due to clearance
- This item not identified on NCR
- Grinding required

Lead Area



- G-11 Lead fillers fit tight to the lead opening clearance

Divots/ Machining Flaws

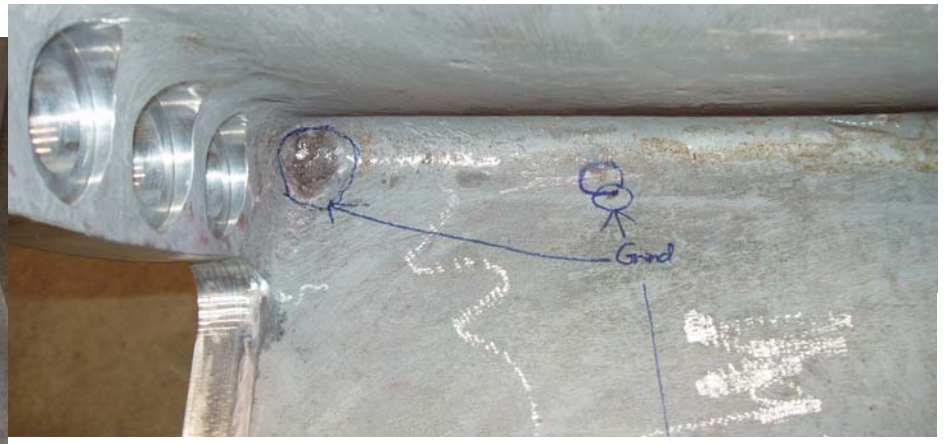
Surface divots on winding faces, need to be epoxy/glass bead filled to minimize locking/keying of the VPI'd coil to the winding form

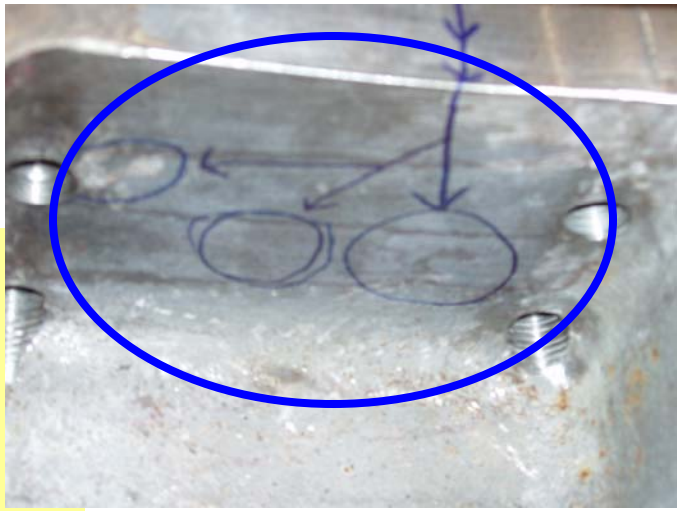
Miscellaneous Items

- Carbon steel bushings left in casting (4)
- Need to be drilled out

- 35 c'bored holes too deep
- New bushings need to be manufactured
- NC19215

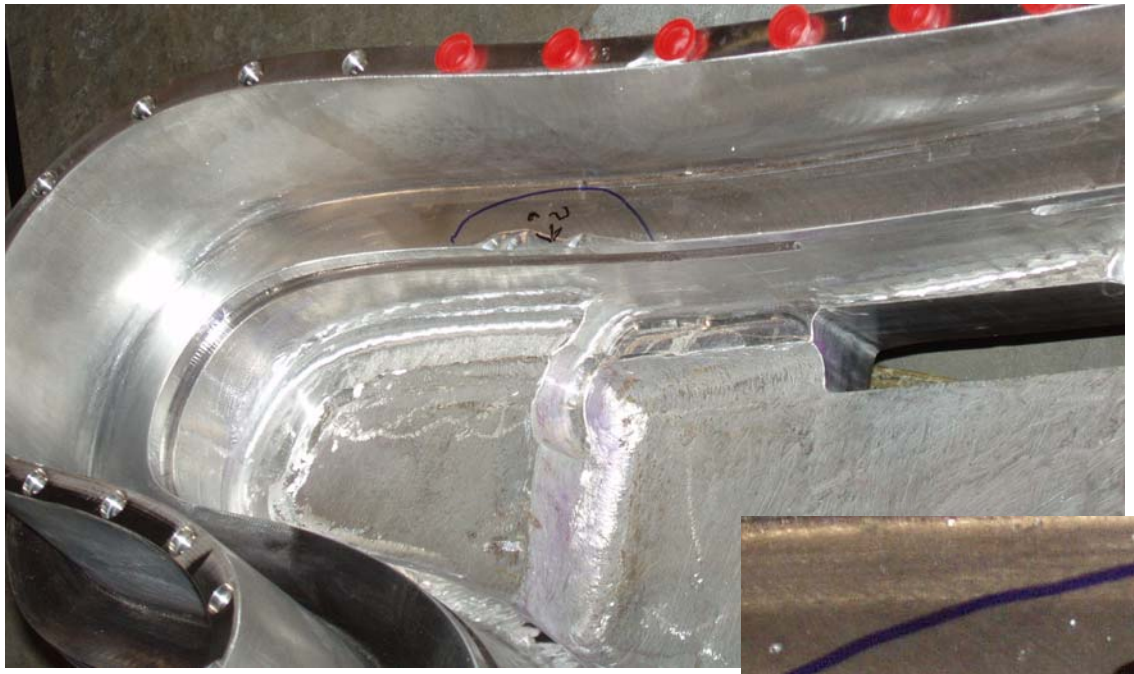
Permeabilty Concerns





- A number of areas were identified with high Permeabilty [dark areas]
- Permeability >1.02 μ
- In-house grinding is required
- This was not an inspection requirement but foundry and Major tool needs to aware of contamination from ferrite lifting chains etc.

Edge Tool Cutting Errors- Critical



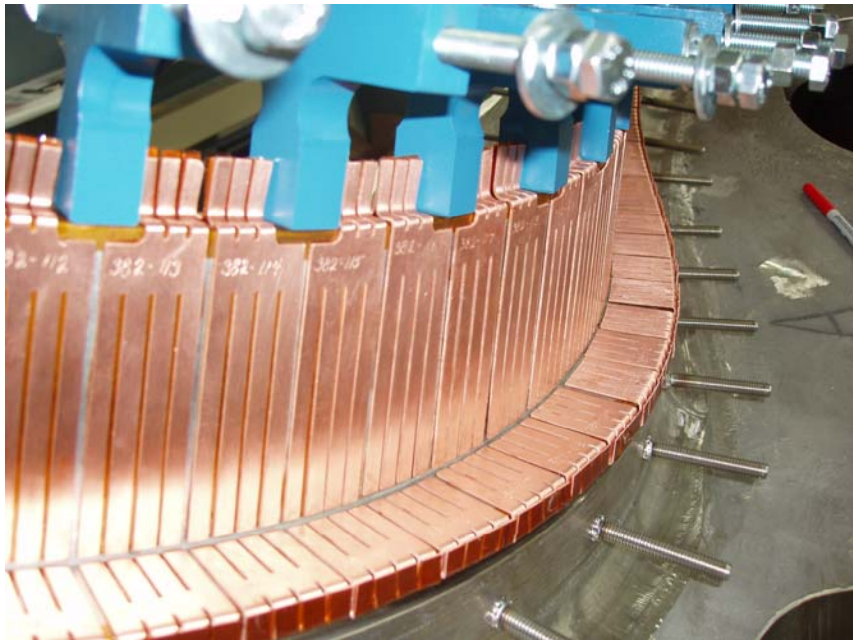
- Edge tool cutting error near hole #95
- Approximately 4 ¼ in. long x 3/8 in. wide 1/8 in. deep
- **Not identified on NCR**

- Requires repair prior to using coil form
- Suggest taking video or digital shoots of entire surface for review prior to shipping

Edge Tool Cutting Errors- Critical

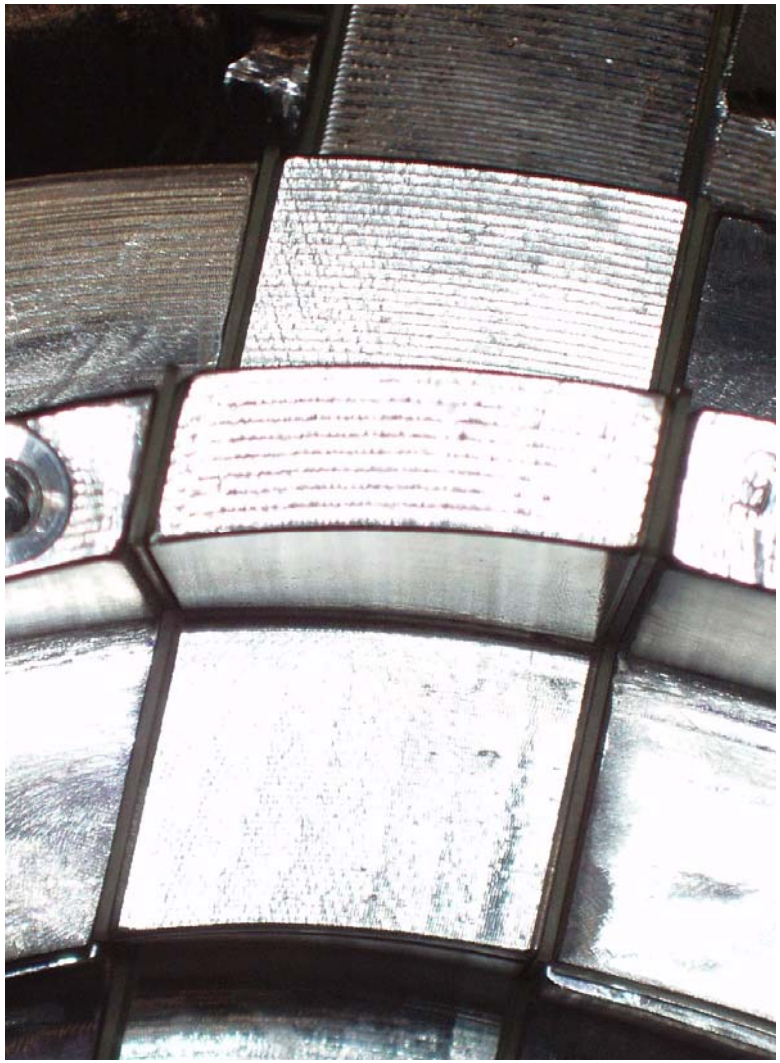
- (2) additional undocumented edge tool cutting errors were observed
- Bolt hole locations # 37 [¾ in. long x 1/8 in. deep x 3/32 in. wide]
- Bolt hole location # 47 [2 ¾ in. long x 3/16 in. wide x 3/16 in. deep]
- **Not identified on NCR**

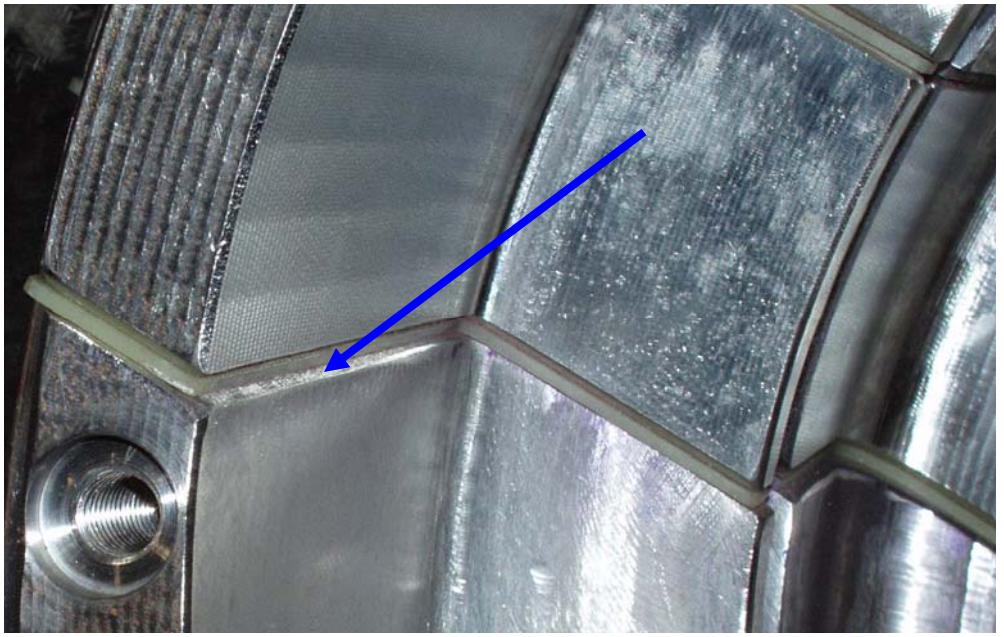
Cladding Installation



- Edges need to be true to allow for cladding installation and dimensional control
- Major edge flaws do not allow for cladding to be properly positioned and secured
- Electromagnetic loads as high as 4500 pounds per inch must be reacted by the casting.

Poloidal Break





- Poloidal break insulator and shim is shifted
- Adjacent surfaces do not align
- Some rework will be required
- **Not identified on NCR**

Poloidal Break- continued

- G-11 insulator extends beyond flange [one side]
- Insulators need to be trimmed

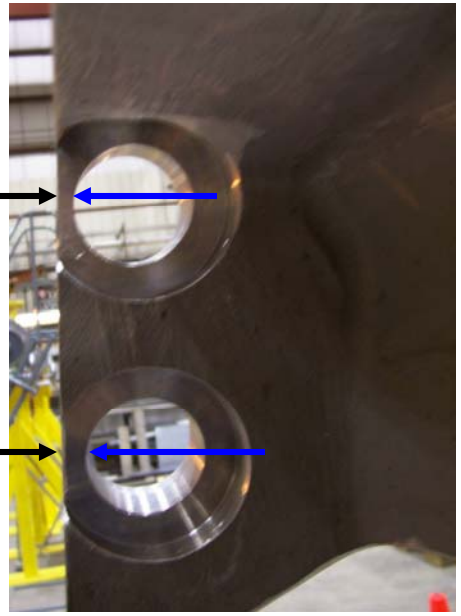
Misaligned Holes

¼ in. hole to edge

[cb04]

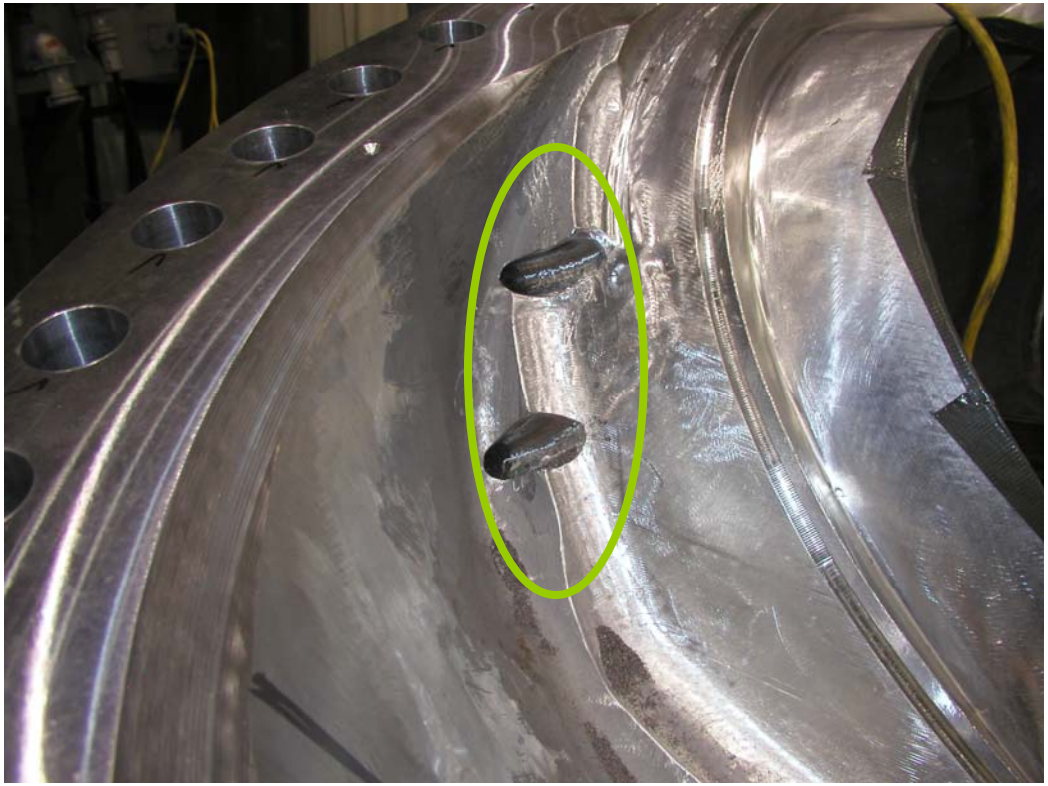
3/8 in. hole to edge

[cb05]



- Flange holes appear to be too close to edge
- Cause unknown?

Excess material



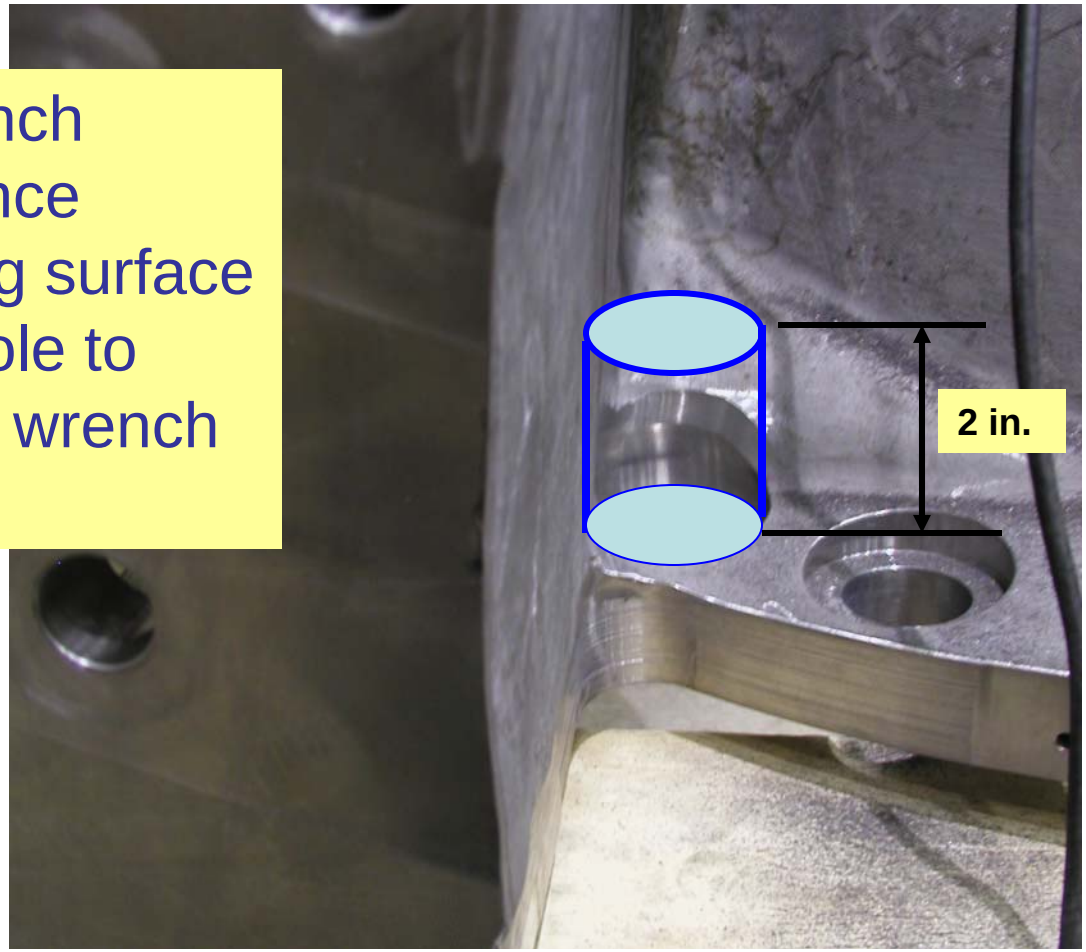
- Excess material remained over-hanging holes preventing straight line of sight
- Excess material had to be ground to provide clearance
- Should have been found

Flange Hole Clearances

It appears that there is over cast material on the C3 winding form in some of the flange bolt area, causing potential problems during assembly.

Clearance Requirements

- NCSX needs 2 inch minimum clearance above the casting surface at each flange hole to allow for nut and wrench clearances



Summary

- Poloidal break alignment must be better addressed in future winding forms
- Tool cutting errors on winding surface edges are not acceptable and needs to be addressed prior to winding coil
- Flange hole clearances present a problem during assembly
- **Not all findings were covered by NCR's**
- More awareness of permeability contamination from ferrite materials[<1.02 μ]
- Project needs to address tight clearances for flange bolts
- 2 inch vertical clearance required above flange holes
- EIO needs to be aware of our casting vs. bolt access problems